MRSA:

Understanding Clinical Management and Epidemiological Issues

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Objectives:

- Understand Hx of MRSA and cMRSA
- Understand epidemiology of MRSA
- Understand methods of MRSA screening and prevention
- Understand treatment and prophylaxis for MRSA

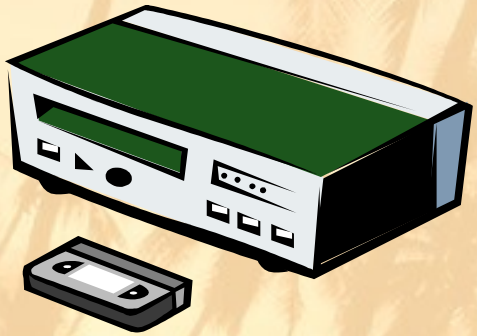
STRANGE MATTER
by nick d. kim strange-matter.com
Pssst! Hey kid! Wanna be a Superbug..?
Stick some of this into your genome...
Even penicillin won't be able to harm you..!

It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.

History

- Pre-antibiotics staph Mortality 90%
- 1940s Pen G by 1945 12-22% Resistance (β-lactamase)
- 1959 Methicillin-resists β-lactamase
- Immediately noticed resistance (MRSA)

MRSA Genetics



Staphylococcal cassette chromosome

- *MecA* is the gene in all MRSA
- Codes for a different PBP (2a)
- B-lactam cannot bind
- Located on the SCC
- Reservoir for other drug resistance

MRSA Genetics

MRSA

- SCC *MecA* I,II,III
- Hospital isolates
- 34-67 kb in size
- Other Antbx Resistance genes

cMRSA

- SCC *MecA* IV, V
- Community isolates
- 20-27kb in size
- Only *MecA* gene

Community-Acquired MRSA

- Outbreaks in community of serious skin/soft tissue infections or necrotizing pneumonia
- MRSA isolates--multiply susceptible, share a type IV SCC*mec* cassette & the PVL locus;
- Are resistant to PCN, Oxacillin, E-mycin
- PVL MRSA strains:
  - Are widely distributed in some communities
  - Have been transmitted in hospitals

F Vandenesch, et al. EID 2003;9:978-84
BA Diep, et al. JCM 2004;42:2080-4
V Boussaud et al Intensive Care Med 2003;29:1840-3
L Saiman, et al CID 2003;37:1313-9

Panton-Valentine Leukocidin (PVL) I

Lina et al, CID: 29:1128, 1999

- Belongs to family of synergohymenotropic toxins
- These damage membranes by synergistic actions of 2 nonassociated secretory proteins, S and F
- Oligomer forms polymer
- Lytic for wide variety of cell lines

cMRSA sepsis syndrome

- Infants and young children
- Hypotension and shock
- Necrotizing pneumonia (esp after flu)
- Coagulopathy: Waterhouse - Friderichsen.
- Thrombocytopenia
- High mortality
- MSSA or MRSA. Type G
- More common than meningococcemia in Chicago

cMRSA in the DoD

- MCRD§
  - 206 trainees 22 MRSA
  - Risks-roommate with skin problems, family member HCW
- Parris Island Outbreak 2002¶
  - 235 cases 5 mos
  - Likely point source and clonal
  - Broken w/ increased hygiene, Mupirocin/Chlorhexidine, Minocycline+Rifampin
- Trippler AMC clinics‡
  - 2% colonization, NOT clonal

§ Russell, K J clin Micro 2004 42:4050-3

¶ Zinderman, C EID 2004

‡ Kenner, J ICHE 2003:439-44

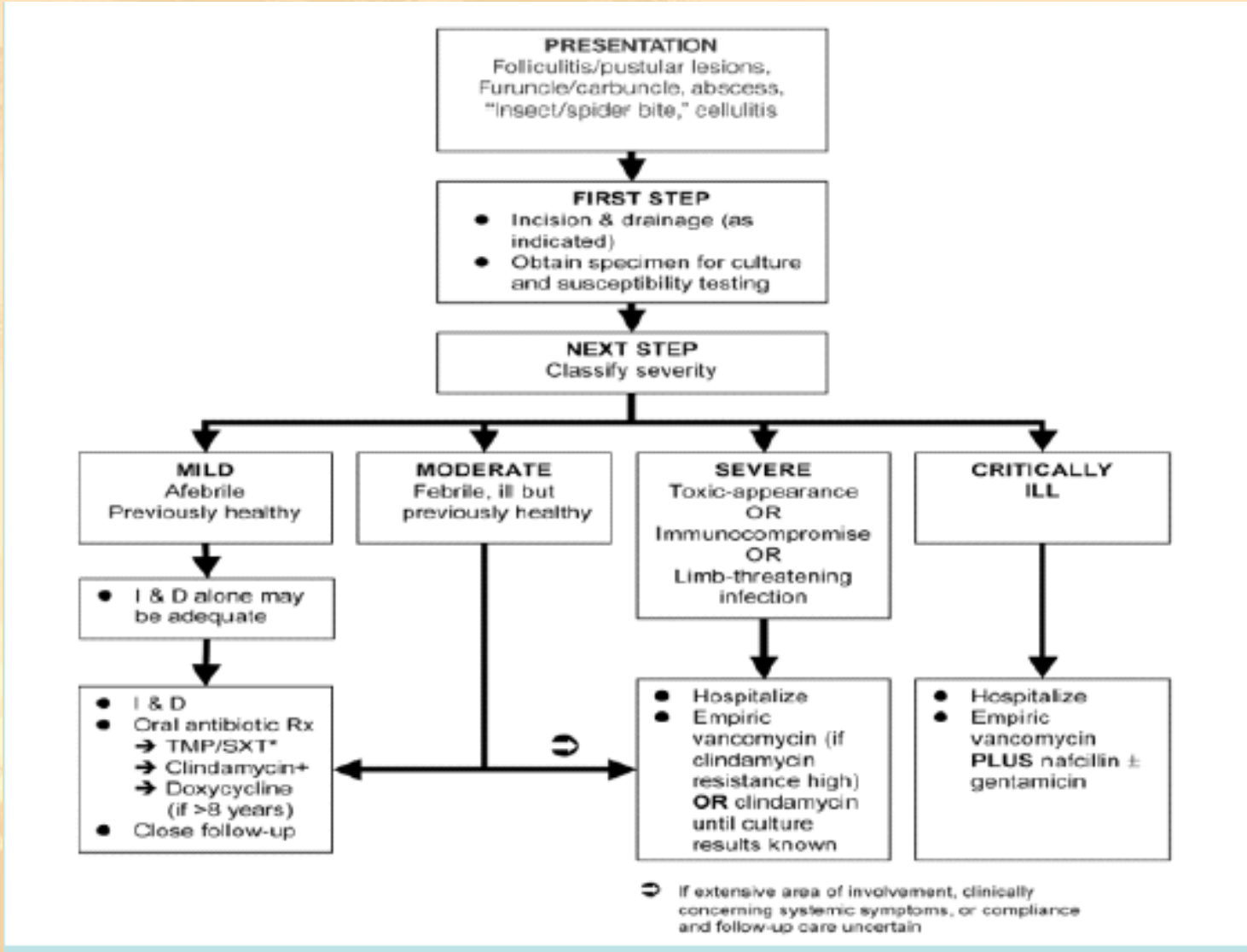
cMRSA Therapy Inpatient

- Drainage is essential
- Vancomycin 1mg/kg is gold standard
  - May need q8h dosing in young adults
- Daptomycin (Cubicin) 4mg/kg qd
  - May have anti-toxin effect

cMRSA therapy

- Drainage is essential
- TMP/SMX or Doxycycline +/- Rifampin
- 2nd gen FQ (Levo,Gati,Moxi) + Rifampin might be OK (ask ID first)
- Clindamycin (if D-tested)
- NO Macrolide/Augmentin

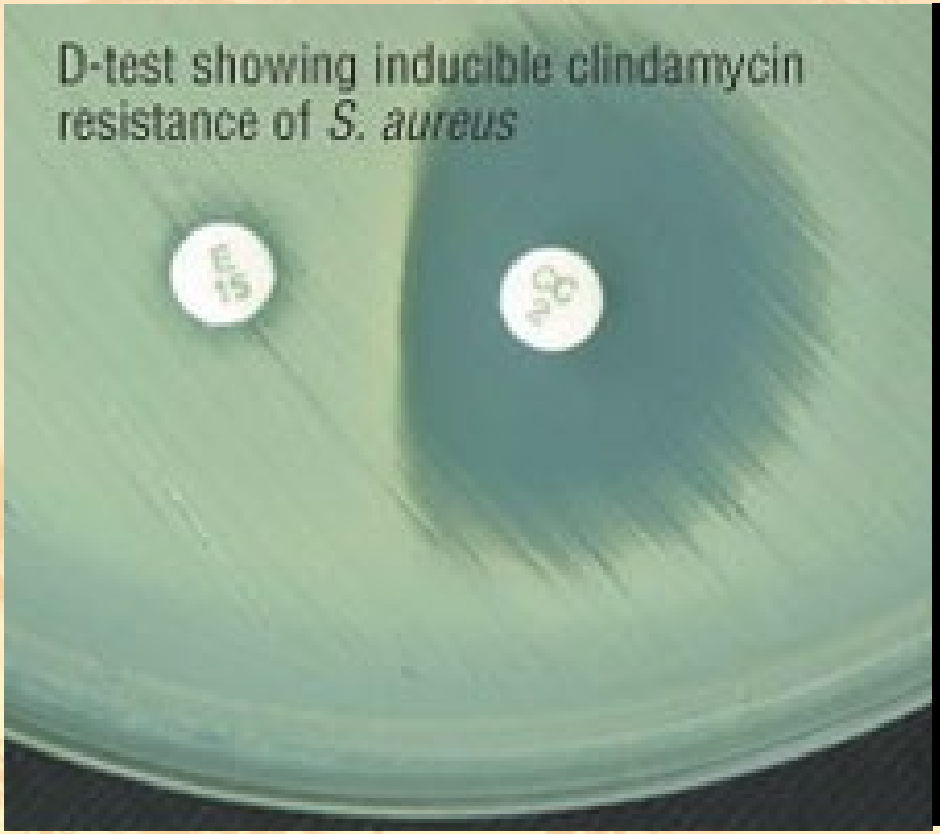
cMRSA Therapy

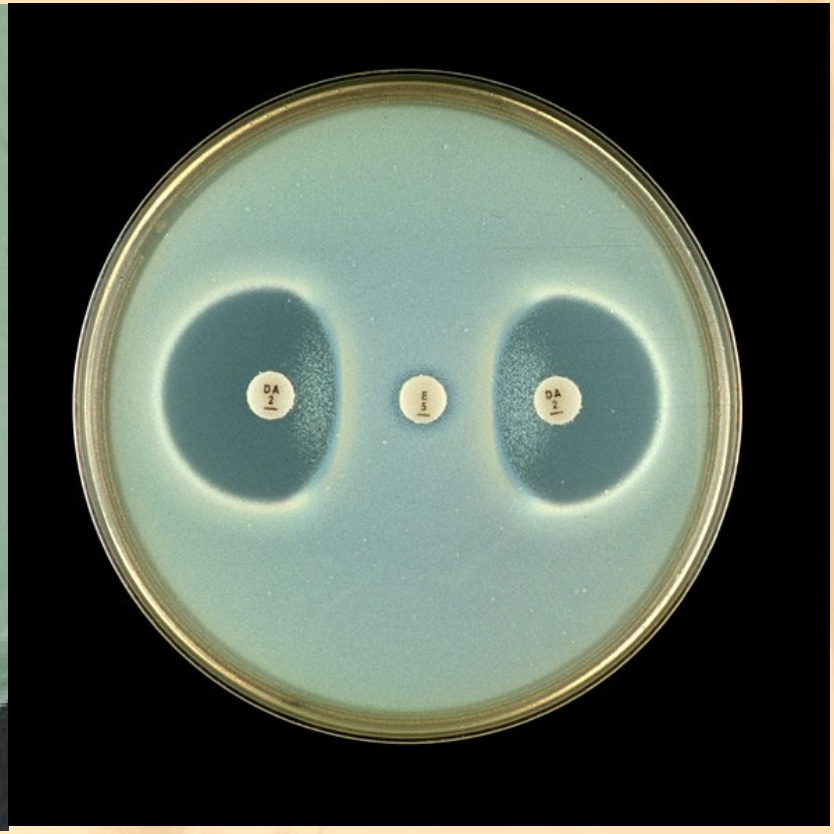


cMRSA Therapy-clindamycin?

- Yes, if the patient is a child, mild to moderately ill, to be managed as an inpatient or an outpatient.
- No, if the patient is a child, critically ill, to be managed as an inpatient.
- Probably not if the patient is an adult, mild to moderately ill, to be managed as an inpatient or an outpatient without a “D-test” from the lab
- No, if the patient is an adult, critically ill, to be managed as an inpatient.

D-test





Navy MTF labs should do this as SOP for all MRSAs

MRSA Epidemiology-persistence

- In a Swiss hospital Among 151 previously known MRSA carriers, MRSA carriage had persisted for > 1 year in 55 patients (36%)
- Median interval from first MRSA: 1 year (interquartile range, 0-2 years)

Screening for MRSA

- Universal screening for all admits?
- Selective screening for some?
- Screen no one?
- Why screen?
  - Need to have an isolation policy before testing patients

Yield of admission screening

Multicenter study, 14 ICUs, 6 months

All admitted patients screened for MRSA, within 24 h.

- Nasal and skin (or wounds) swabs
- Prevalence of MRSA: 6.9% (162/2347 admissions):
  - Medical ICUs: 6.1%
  - Medical-surgical ICUs: 7.0%
  - Surgical ICUs: 10.3%
- Yield of admission screening:
  - MRSA previously known: 37.7%
  - Positive clinical specimen for MRSA: 18.5%
  - MRSA identified by admission screening only: 54.3%

(Lucet JC et al, Arch Intern Med, 2003)

Selective screening

- Adherence to admission screening can be low
- Objective: Simple score to be used at bedside, with information available at hospital admission
- Automatic alert to identify patients to be screened:
  - Screening of patients with:
    - » Previous admission within 6 m.
    - » Transfer from another healthcare facility
    - » ICU length of stay LOS > 4 d.
    - » Length of stay > 6 d. plus an antibiotic
    - » Length of stay > 21 d.
    - » Colonization with VRE

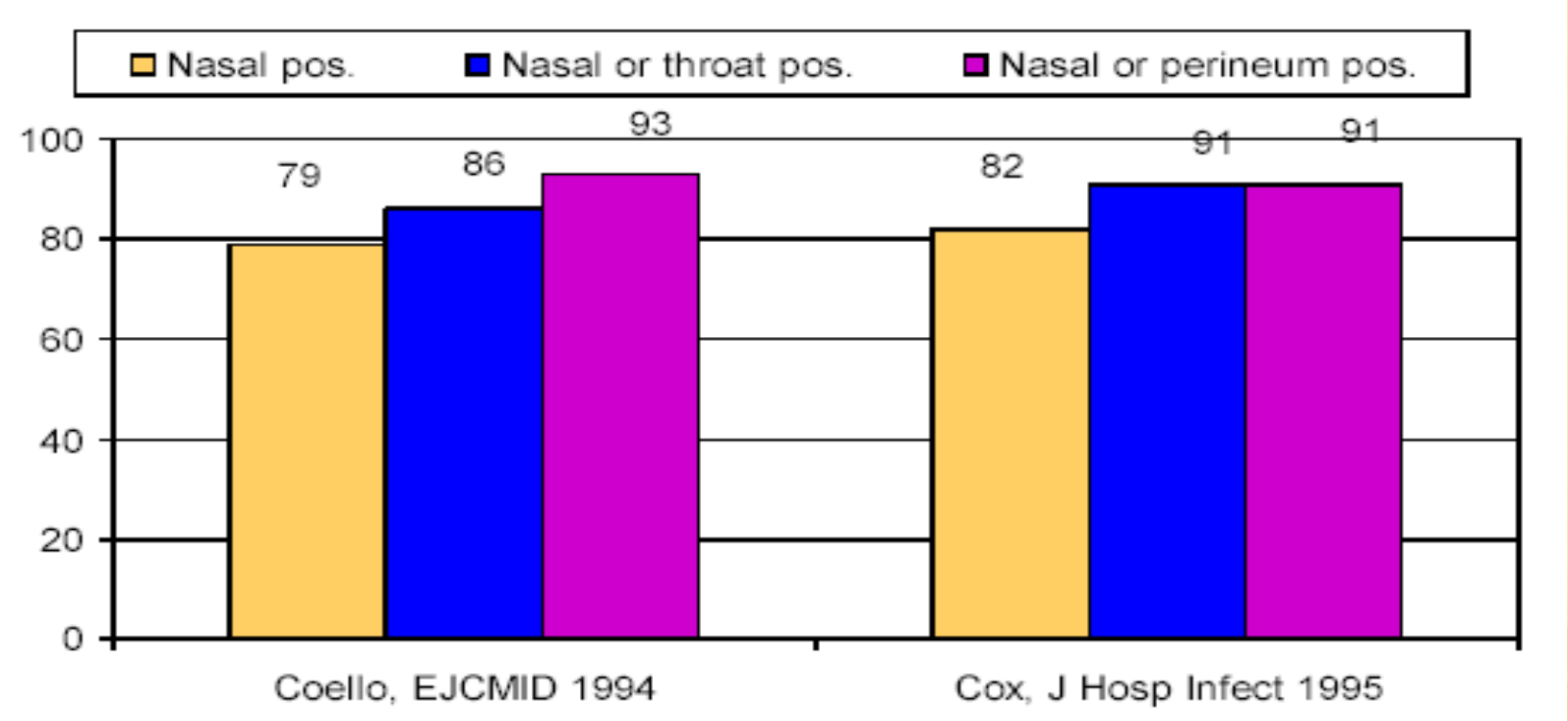
(Karchmer TB, SHEA meeting, 2003)

Which screening samples?

Sensitivity of screening samples

Sensitivity of nasal screening: 60%-80%

- Should we add another site?
- Perineum and throat increase yield



Factors associated with MRSA carriage at admission

- Previous MRSA carriage
- Hospitalization:
  - Admission from nursing home, rehabilitation unit, other hospitals
  - History of hospitalization during the previous year
- Concurrent VRE carriage *(Furuno JP, ICAAC 2004)*
- Patient-related risk factors:
  - Male gender, smoker, diabetes
  - Presence of skin lesions
  - Poor chronic health status
  - Older patients (60+, 75+, 80+)
  - Presence of invasive procedures on admission (urinary catheter,central venous catheter, gastric tube, …)
  - Receipt of antibiotics within 3-6 months

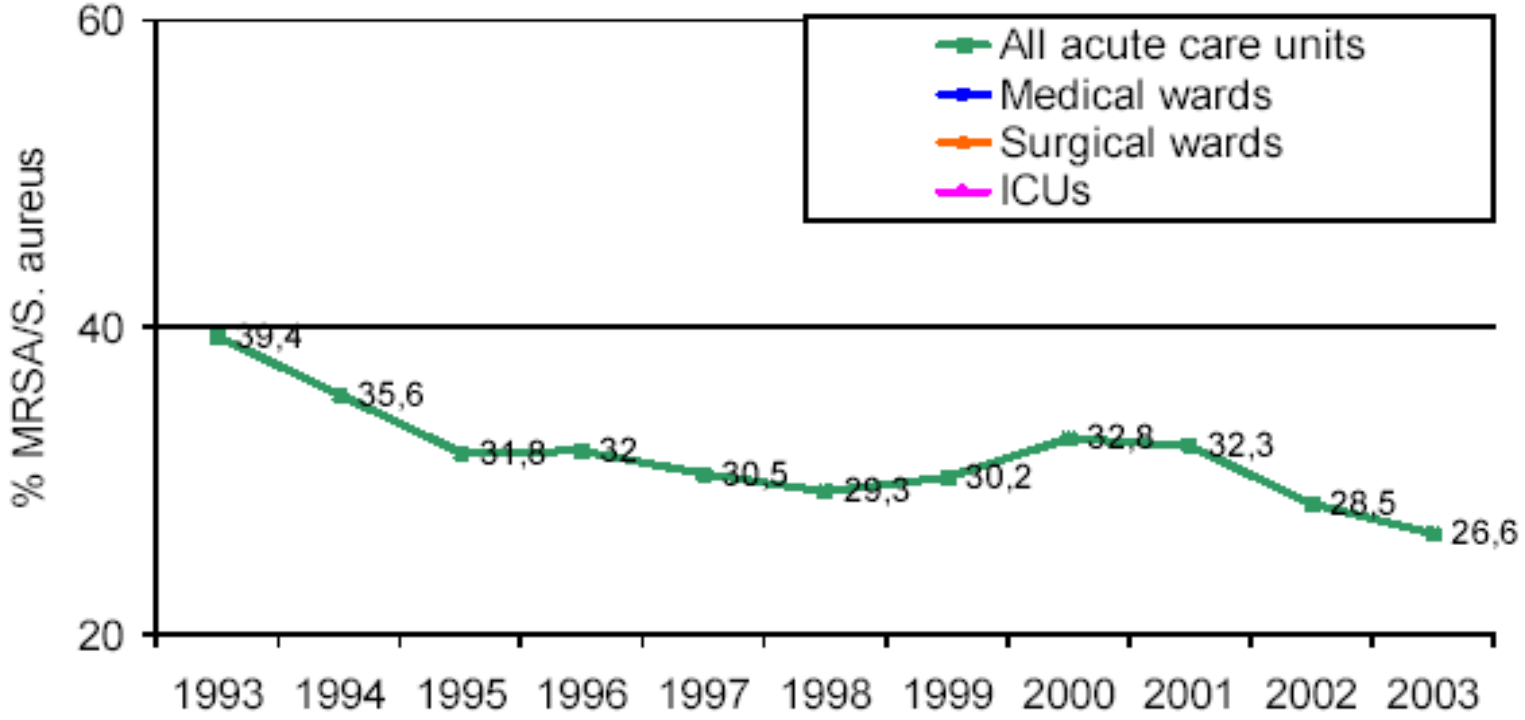
Isolation plus screening high risk patients

- Contact precautions, similar to CDC recommendations
- Screening of high-risk patients
- No recommendation for topical decontamination
- Yield might have been better with decon

Impact of a combined strategy

Public hospitals (n= 43), Paris

2 months/year (≈ 200,000 patients, ≈ 2000 MRSA), clinical cultures only, excluding duplicates



Jarlier V, Department of Microbiology, Bull. Epidémiol. Hebdo, 2004: 148-151

Available at: http://www.invs.sante.fr/beh/2004/32_33/

Future MRSA screening

- Different methods available (PNA-Fish, PCR etc)
- Techniques differ in terms of:
  - sample source (nasal only): missing 17%
  - risk of systematic errors: SCCmec types
  - low/high throughput: practical lab work
  - costs: from 5 to 30$
- Realistic ONLY WHEN combined with adequate infection control measures

MRSA eradication

- Need to have all lines/devices out and all wounds healed or it will fail
- Mupirocin 2% in nares q8h f10d
- Chlorhexidine showers bid f10d
- Consider an oral antibiotic regimen (TMP/SMX DS bid +Rif 600mg)
- This achieved 61% decolonization initially and 50% at 6 months

NNMC screening process-readmits

- MRSA patients are ID’ed by Infection Control
- They are annotated in CHCS as MRSA
- When patient is admitted Admission Cover Worksheet has their MRSA status on it
- Annotation maintained for 1 year
- If patient is eradicated, taken out of database

Summary

- Multiple MR *S. aureus* isolates are circulating in the community
- PVL major virulence determinant but not universal and not the whole story of pathogenesis
- Many (?most) cMRSA isolates are MSSA isolates with SCC*mec* IV (Or V) in them
- cMRSA can be treated with TMP/SMX, Doxy, Rifampin, or Vancomycin and Daptomycin IV
- Clinda should be used only in mildly ill kids and only in adults with a negative D-test

Summary

- MRSA patients should be identified at d/c and re-isolated at readmission
- High risk patients (recruits, midshipmen, lines, open wounds, renal failure, readmits, SNFF/rehab etc) should be isolated & screened at admission
- MRSA eradication works 50-61% of time.

Questions?